

In the claims:

1. (currently amended) A system for aiding a ~~user~~ person with a visual impairment or visual obstruction, comprising:

means for sensing time/space characteristics and physical characteristics information about ~~an~~ a plurality of objects in a field of view of said person;

means for identifying, interpreting, decomposing, and synthesizing said time/space characteristics and physical characteristics information and for high-level characterizing ~~(recognition)~~ the said plurality of objects; and

~~audible information delivery device (Mmeans for verbally communicating) for audibly output and input information between said system and describing to the said user the characterization of the object and said interpretation about the object.~~

2. (currently amended) The system according to claim 1, wherein said means for sensing ~~further~~ comprises image sensing devices selected from the group consisting of: CCD sensors, and a 3-D laser imaging sensors, ~~radar sensors, electromagnetic radiation sensors.~~

3. (original) The system according to claim 1, wherein said time/space characteristics and physical characteristics information about an object includes any of: physical dimensions, general shape description, texture, color, the distance and position of said user from said object, motion of said object, spatial relationships between objects.

4. (currently amended) The system according to claim 1, wherein said means for interpreting said time/space and physical characteristics information comprises: a Sensors Processor, ~~a~~ and Control Unit (SPC) for interpreting low-level sensing data from said sensing means, and a High-level Vision Processing module for interpreting high-level sensing data from said sensing means.

5. (currently amended) The system according to claim 1, further comprising a World Model knowledge database wherein for performing said high-level characterizing ~~(recognition)~~ is performed by.

6. (deleted)

7. (currently amended) The system according to claim 5, wherein said ~~learning process by~~ a World Model database is continuously enriched by adaption to new experiences of said person and implemented in at least one option selected from the modes ~~enrichment learning process comprises:~~

direct teaching mode;

generalization teaching mode by positive enforcement or default; and

refinement teaching mode by negative enforcement or correction.

8-9. (deleted)

10. (currently amended) An apparatus for aiding in ~~obstacle avoidance~~ a visually impaired or blind person to detect and identify said plurality of objects in his field of vision, comprising:

at least one ~~electro-optical~~ computerized imaging device ~~to~~ for detecting and identifying said ~~at least one~~ plurality of objects;

a Processing and Control Unit ~~which~~ for receiving and processes information from said at least one computerized imaging devices and said person; and

a User ~~communication~~ Interface Module ~~to~~ for receiving instructions from said Processing and Control Unit for the purpose of audibly verbally describing to said person said plurality of objects in said field of vision, thereby enabling said person to cope with and proceed in ~~said the~~ surroundings.

11-25. (deleted)

26.(currently amended) The apparatus according to claim 10, further comprising an automatic speech recognition unit for verbal input of instructions from said person to said Processing and Control Unit ~~information processing~~.

27. (currently amended) A method for detecting, analyzing, and identifying, and reporting at least one a plurality of objects by name to a visually impaired or blind person in a field of vision view of said person, and ~~notifying the user~~, comprising the steps of:

providing a 3-D laser imaging system to accurately measure both the coordinates of said plurality of objects in both static and dynamic motion and the characterization of the relationships between said plurality of objects in relation to said person;

acquiring a plurality of 3-D visual images of and information about said at least one plurality of objects;

processing said plurality of 3-D visual images and said information;

storing said information of said plurality of objects by names in a hierarchy utilizing a structured World Model;

identifying said at least one plurality of objects, and audibly communicating verbally with said person to report said information about ing at least one said plurality of objects in said field of vision view.

28-30. (deleted)

31. (currently amended) The method according to claim 27, ~~and~~ further comprising 3-D object rendering.

32-34. (deleted)

35.(currently amended) The method according to claim 27, ~~and~~ further comprising communicating the verbal description of said virtual world image the scene related to said plurality of objects in said field of vision to said person.

36. (currently amended) A system for aiding a user person with a visual impairment or visual obstruction, comprising:

a means for sensing time/space characteristics and physical characteristics information about ~~an~~ the physical environment in a field of view of said person;

means for identifying, interpreting, decomposing, and synthesizing said time/space characteristics and physical characteristics information and for high-level characterizing ~~(recognition)~~ the said physical environment; and

~~audible information delivery device~~ ~~(means for verbally communicating)~~ a scene description ~~for audibly~~ describing to ~~the~~ said user person the characterization of and said interpretation about ~~the~~ said physical environment ~~the environment~~.

37. (new) The system according to claim 36, wherein said means for sensing comprises image sensing devices selected from the group consisting of: CCD sensors, and a 3-D laser imaging sensor.

38. (new) The system according to claim 5, wherein said World Model database comprises data selected from the group:

physical descriptions of known objects and components thereof;

the relations of said objects to their respective said components;

common relations among said components;

groupings of said known objects into classes and subclasses;

common properties of said classes, subclasses and groupings; and

common relations among and between said classes, subclasses and groupings.

39. (new) The system as in claim 7 wherein said direct teaching mode comprises giving a name to a part of a scene by said user.

40. (new) The system as in claim 7 wherein said generalization teaching mode comprises identifying a part of a given scene as belonging to a specific object class, although some of the relationships, or some of the components, may deviate from that identified in said database.

41. (new) The system as in claim 7 wherein said refinement teaching mode comprises refining the set of definitions to permanently exclude in the future an identification of only part of a scene as belonging to a specific object class when said user has rejected said partial identification.

42. (new) The apparatus according to claim 10 wherein said User Interface Module receives verbal instructions from said person in a direct teaching mode to improve said World Model knowledge database capabilities for naming and classifying a plurality of objects within said field of view.

43. (new) The system according to claim 1, wherein said means for interpretation comprises scene interpretation data and sensed data streams.

44. (new) The system according to claim 1, wherein said means for interpretation further comprises computations for relating distances and color information of said plurality of objects and components thereof within the field of vision of said person.

45. (new) The system according to claim 1, wherein said output information comprises said characterization and interpretation of said plurality of objects.

46. (new) The system according to claim 1, wherein said output information further comprises a scene description about said surrounding environment within the field of view of said person.

47. (new) The system according to claim 46, wherein said scene description is verbally communicated in conversational speech to said person based on the distance of said plurality of objects to said user, the closest being communicated first as having a higher priority.

48. (new) The system according to claim 46 wherein said scene description comprises a hierarchy of object classes identified by said system, together with their position information, physical characteristics, and relative velocity vectors indicating motion.

49. (new) The system according to claim 48, wherein said position information, physical characteristics, and relative velocity vectors information are interpreted by an Object Synthesis and Recognition module.

50. (new) The apparatus according to claim 26, wherein said instructions comprise naming and classifying objects known to said user.

51. (new) The method of claim 27 further comprising:

reflecting and capturing laser pulses from the surfaces of said plurality of objects present in close range to said person to produce a "cloud" of spatial pixels (voxels) representing points on all said surfaces which can be observed from said person's point of view;

applying a set of low-level algorithms to decompose said "cloud" into a set of regular surfaces defined by parameters of type, dimensions, orientation in space, and relative (to said user) velocity vector; and

applying a set of high-level algorithms to act on said surfaces to combine them into identified 3-D objects with assigned names.

52. (new) The method of claim 27 yet further comprising;

providing a process of learning new facts about said physical surroundings of said person for growth and expansion of said World Model.

53. (new) The method of claim 27 wherein said World Model hierarchically represents existing knowledge of the physical surroundings of said person; classes of said plurality of objects; the common relationships among said classes; the relationships of said plurality of objects to their various components; and the way low-level components in said hierarchy can be composed of regular surfaces.